

MEMORANDUM

cc: GEN. FILES

23-68-65.
W.P. 124-64.

To: Mr. B. R. Davis,
Bridge Engineer,
Bridge Division.
Attention: Mr. S. McCombie

FROM: Foundation Section,
Materials & Testing Div.,
Room 107, Lab. Bldg.

DATE: April 19, 1966

APR 26 1966

OUR FILE REF.

IN REPLY TO

SUBJECT:

FOUNDATION INVESTIGATION REPORT
For
Rochester Township Road, Conc. 2
Underpass, Hwy. #401, District #1.
N.J. 66-F-22 -- W.P. 124-64

Attached, we are forwarding to you, our detailed foundation investigation report on the subsoil conditions existing at the above structure site.

We believe that you will find the factual data and recommendations contained therein, adequate for your design requirements.

Should additional information be required please feel free to contact our Office.

AGS/MdeF
Attach.

cc: Messrs. B. R. Davis (2)
H. A. Tregaskes
D. W. Farren
A. Gater
F. C. Brown
J. Roy
A. Watt

Afternoon
A. G. Stermac,
PRINCIPAL FOUNDATION ENGINEER

Foundations Office
Gen. Files ✓

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FOUNDATION INVESTIGATION REPORT
For
Rochester Township Road, Conc. 2
Underpass Hwy. #401, Dist. #1
W.J. 66-F-22 -- W.P. 124-64.

1. INTRODUCTION:

A request to carry out a foundation investigation at the proposed Rochester Twp. Road and Hwy. #401 Underpass, was received from the Bridge Location Section dated Nov. 29, '65. It is proposed to erect a new bridge at this location to carry the revised gravel road over Hwy. #401. At this location the chainage of the gravel road is from Sta. 14+02 to Sta. 15+98.

In order to determine the soil properties and decide on the type of foundation, an investigation was carried out by this section. Results and discussion of the field and laboratory investigations, as well as conclusions and recommendations for the future design work, are contained in the following paragraphs of this project.

2. DESCRIPTION OF SITE:

The site of the future bridge is located in the County of Essex, Twp. of Rochester, Lot 18, Con. 2 E.B.R. The surrounding area is generally flat terrain.

Physiographically, the site is located in the so-called St. Clair Clay Plains.

3. FIELD AND LABORATORY WORK:

In order to obtain sufficient information on the type and properties of the subsoil, five sampled boreholes and ten

cont'd. /2

3. FIELD AND LABORATORY WORK: (cont'd.) ...

penetration tests were carried out at this site. Split-spoon and thin-walled samples were taken at various depth intervals. In-situ vane tests were performed in B.H. #5, 18" below the bottom of the thin-walled sampler, immediately after the samples were removed.

Samples recovered in the split-spoon and thin-walled samplers were used to determine the following physical properties:

1. Natural Moisture Contents.
2. Bulk Densities.
3. Grain Size Distribution.
4. Atterberg Limits.
5. Undrained Shear Strength.

Results of these laboratory tests are summarized in Appendix I of this report.

4. SUBSOIL CONDITIONS:

4.1 General:

The stratigraphy of the soil at the site was found to be generally uniform. A detailed description of various soil types encountered during the investigation, is shown in Appendix I of this report, and is also given in subsequent paragraphs. The estimated stratigraphical profile shown on Drawing #6 F-22A, is based upon this information.

4.2 Silty Clay to Clayey Silt with Traces of Sand and Gravel. (Glacial Till).

From groundlevel extending for the entire depth of soil exploration a "silty clay to clayey silt stratum with traces of sand and gravel" was observed at each borehole location. Owing to the glacial origin of the subsoil the sand and gravel size material was encountered irregularly within

cont'd. /3

4. SUBSOIL CONDITIONS: (cont'd.) ...

the deposit as thin seams or small lenses. The consistency of the stratum was found to be hard within the upper 10 ft., corresponding to standard penetration "N" values of 55-73 blows/ft. There is a gradual decrease in the consistency below 10 ft., being "hard to very stiff" between 10-30 ft. (El. 590-570) and "stiff" below that depth, indicated by "N" values of 8-15 blows/ft.

Liquid Limits for this material varied from 20.0% to 39.0%, while plastic limits ranged from 15.0% to 22.0%. The average moisture content was 19.0%, ranging from 14% to 34.2%. A typical plasticity chart is given in Appendix I of this report.

Two soil samples were subjected to grain size analysis. The results of the tests indicate that the stratum is heterogeneous containing various percentages of sand sized grains.

Field vane together with laboratory unconfined compression and unconsolidated undrained triaxial shear tests indicated values of shear strength in excess of 2000 p.s.f. above El. 560ft.; whereas they were computed to be between 900 p.s.f. to above 2000 p.s.f. below El. 560 ft.

4.3 Clayey Silt with Sand (Glacial Till) Very Dense:

Following the silty clay to clayey silt stratum is a deposit of clayey silt with sand (Glacial Till). It may be classified as very dense with an average "N" value in excess of 150 blows/ft. No samples were recovered in this layer.

5. GROUND WATER CONDITIONS:

The ground water level, at the time of the investigation was found to be between the elevation 591.0 and 592.0. It may be assumed that the ground water level will vary with

cont'd. /4

5. GROUND WATER CONDITIONS: (cont'd.) ...
the seasons of the year.

No Artesian water conditions were encountered.

6. DISCUSSION AND RECOMMENDATIONS:

As was described in the previous paragraphs, the subsoil basically consists of silty clay to clayey silt with traces of sand and gravel with a consistency ranging from hard to stiff, followed by very dense clayey silt with sand (Glacial Till). The investigation has revealed that within the upper layers of the deposit, the properties are such that adequate support for spread footings can be obtained. It is recommended to place the footings approximately 5'-0" below existing original groundlevels at apprximate el. 595.0. A net allowable pressure of 2.5 t.s.f. may be assumed for design purposes.

Due to the fact that the subsoil consists of about 100 feet of compressible material some long term settlements of the structure and approaches must be anticipated. Computations based on conventional methods indicate that differential settlements in the order of 3 inches will occur between the abutments and the centre pier over a long term period. Experience shows however that in this type of subsoil actual settlements are much less than theoretical settlements. The structure should nevertheless be designed on the basis that differential settlements in the order of $1\frac{1}{2}$ - 2 inches are quite possible.

If perched abutments are used, they may be founded within the approach fills on 12 3/4" x $\frac{1}{4}$ " steel tube piles or 12" \emptyset concrete piles driven to el. 590.0 A design load of 30 tons per pile may be used in this event.

cont'd. /5

6. DISCUSSION AND RECOMMENDATIONS: (cont'd.) ...

Since the soil consists of relatively impervious material and the water level is low, dewatering should not present problems. No stability problems are anticipated with the approach fills, provided 2:1 slopes are constructed.

7. SUMMARY:

1. The stratification of the soil, which consists of hard to stiff silty clay to clayey silt, followed by very dense clayey silt with sand (Glacial Till), is quite uniform.

2. Because of the hardness of the upper layers, spread footings may be used for the proposed structure with a design load of 2.5 t.s.f.

3. If perched abutments are used, they may be founded within the approach fills on 12 3/4" x 1/4" steel tube piles or 12" Ø concrete piles driven to el. 590.0. A design load of 30 tons per pile may be used in this event.

4. Dewatering of the excavations should not present major problems.

5. No stability problems are anticipated for the approach fills.

8. MISCELLANEOUS:

The field work, performed during the period from Feb. 24 to Mar. 4, 1966, together with the preparation of this report, was undertaken by Mr. W. W. Kulmatickas, Project Foundation Engineer. The investigation was carried out under the general supervision of Mr. K. G. Selby, Senior Foundation Engineer, who also reviewed this report.

April 1966.

APPENDIX I

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 1

FOUNDATION SECTION

JOB 66-F-22LOCATION Gravel Rd. Sta. 15498, 17' Rt. of CORIGINATED BY W.W.K.W.P. 124-64BORING DATE March 7, 1966.COMPILED BY A.K.B.DATUM GeodeticBOREHOLE TYPE Dynamic Cone Penetration.CHECKED BY K.G.S.

| SOIL PROFILE | | | SAMPLES | | | ELEV. SCALE | DYNAMIC PENETRATION RESISTANCE | | LIQUID LIMIT — WL | | BULK DENSITY P.C.F. | REMARKS |
|--------------|---------------------|-------------|---------|------|--------------|-------------|--------------------------------|-----------------------|--------------------|-------------------|------------------------|---------|
| ELEV. DEPTH | DESCRIPTION | STRAT. PLOT | NUMBER | TYPE | BLOWS / FOOT | | BLOWS / FOOT | SHEAR STRENGTH P.S.F. | PLASTIC LIMIT — WP | WATER CONTENT — W | | |
| 600.3 | Groundlevel | | | | | | | | | | | |
| 0.0 | Penetration Only. | | | | | | | | | | | |
| 590.6 | | | | | | | | | | | | |
| 9.7 | End of Penetration. | | | | | | | | | | | |
| | | | | | | 590 | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | 580 | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | 570 | | | | | | |
| | | | | | | | | | | | | |

@590.4' Hammer Bouncing

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 3

FOUNDATION SECTION

JOB 66-F-22

LOCATION Gravel Rd. Sta. 15/63, 17' Rt. of E

ORIGINATED BY W.W.K.

W.P. 124-64

BORING DATE March 10, 1966

COMPILED BY A.K.B.

DATUM Geodetic

BOREHOLE TYPE Washboring, NX Casing.

CHECKED BY K.G.S. *ll*

| SOIL PROFILE | | | SAMPLES | | | ELEV. SCALE | DYNAMIC PENETRATION RESISTANCE | | | | | LIQUID LIMIT — WL | | | BULK DENSITY | REMARKS |
|--------------|---|-------------|---------|------|--------------|-------------|--------------------------------|----|----|----|----|-------------------|--------------------|-------------------|--------------|---------|
| ELEV. DEPTH | DESCRIPTION | STRAT. PLOT | NUMBER | TYPE | BLOWS / FOOT | | BLOWS / FOOT | 20 | 40 | 60 | 80 | 100 | PLASTIC LIMIT — WP | WATER CONTENT — W | | |
| 601.5 | Groundlevel | | | | | | | | | | | | | | | |
| 599.5 | Black org. topsoil | | | | | 600 | | | | | | | | | | |
| 2.0 | | | | | | | | | | | | | | | | |
| | | | 1 | SS | 73 | | | | | | | | | | | |
| | | | 2 | SS | 44 | 590 | | | | | | | | | | |
| | | | 3 | SS | 33 | | | | | | | | | | | |
| | | | 4 | SS | 48 | 580 | | | | | | | | | | |
| | Silty clay to clayey silt with traces of sand and gravel. | | | | | | | | | | | | | | | |
| | | | 5 | SS | 15 | 570 | | | | | | | | | | |
| | Hard to Stiff. | | | | | | | | | | | | | | | |
| 560.0 | | | 6 | SS | 13 | 560 | | | | | | | | | | |
| 41.5 | End of borehole. | | | | | | | | | | | | | | | |

@El. 592.7' Hammer Bouncing

W.L. Elev.
 591.8'

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

JOB 66-F-22

LOCATION Gravel Rd. Sta. 15463. 17' Jct. of E

ORIGINATED BY W.W.K.

W. P. 124-64

BORING DATE March 7, 1966.

COMPILED BY A.K.B.

DATUM Geodetic

BOREHOLE TYPE Dynamic Cone Penetration

CHECKED BY K.G.S. *[initials]*

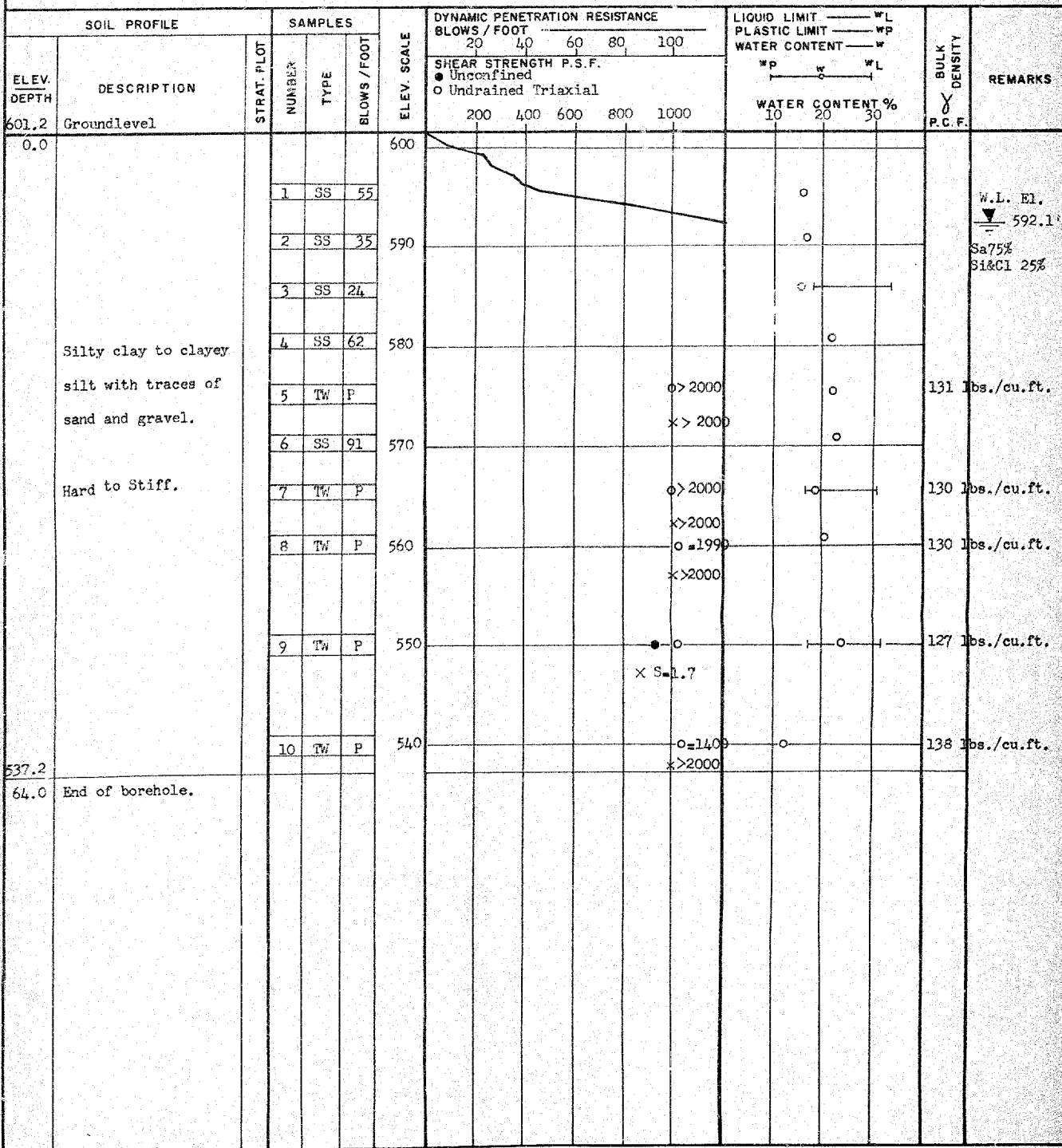
| SOIL PROFILE | | | SAMPLES | | | ELEV. SCALE | DYNAMIC PENETRATION RESISTANCE | LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w | BULK DENSITY P.C.F. | REMARKS |
|--------------|---------------------|-------------|---------|------|--------------|-------------|--------------------------------|--|------------------------|---------|
| ELEV. DEPTH | DESCRIPTION | STRAT. PLOT | NUMBER | TYPE | BLOWS / FOOT | | BLOWS / FOOT | | | |
| 601.8 | Ground Elevation | | | | | | | | | |
| 0.0 | Penetration Only. | | | | | 600 | | | | |
| 590.2 | | | | | | | | | | |
| 11.6 | End of Penetration. | | | | | 590 | | | | |
| | | | | | | | | | | |
| | | | | | | 580 | | | | |

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION
JOB 66-F-22
W.P. 124-64
DATUM Geodetic

RECORD OF BOREHOLE NO. 5

FOUNDATION SECTION

LOCATION Gravel Road Sta. 15+00, 17' Rt. of C ORIGINATED BY W.W.K.
BORING DATE March 11, 1966. COMPILED BY A.K.B.
BOREHOLE TYPE Washboring, NX Casing. CHECKED BY K.G.S. *ll*



DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 6

FOUNDATION SECTION

JOB 66-F-22LOCATION Gravel Rd. Sta. 15+00, 17' Lt. of EORIGINATED BY K.W.K.W.P. 124-64BORING DATE March 12, 1966.COMPILED BY A.K.B.DATUM GeodeticBOREHOLE TYPE Dynamic Cone PenetrationCHECKED BY K.G.S. JR

| SOIL PROFILE | | | SAMPLES | | | ELEV. SCALE | DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100 SHEAR STRENGTH P.S.F. | LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W WP — W — WL WATER CONTENT % | SULK DENSITY P.C.F. | REMARKS |
|--------------|---------------------|-------------|---------|------|--------------|-------------|--|--|------------------------|---------|
| ELEV. DEPTH | DESCRIPTION | STRAT. PLOT | NUMBER | TYPE | BLOWS / FOOT | | | | | |
| 601.0 | Groundlevel | | | | | | | | | |
| 0.0 | Penetration Only. | | | | | 600 | | | | |
| 592.2 | | | | | | | | | | |
| 8.8 | End of Penetration. | | | | | 590 | @El. 592.2' Hammer Bouncing. | | | |

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 7

FOUNDATION SECTION

JOB 66-F-22LOCATION Gravel Rd. Sta. 14+37, 17' Rt. of CORIGINATED BY W.W.K.W.P. 124-64BORING DATE March 11, 1966.COMPILED BY A.K.B.DATUM GeodeticBOREHOLE TYPE Washboring, NX Casing.CHECKED BY K.G.S.

| SOIL PROFILE | | | SAMPLES | | | ELEV. SCALE | DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT | | | | LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W | | | BULK DENSITY Y P.C.F. | REMARKS |
|----------------|---|-------------|---------|------|--------------|-------------|--|--|--|--|--|---|----|--------------------------------|---------|
| ELEV. DEPTH | DESCRIPTION | STRAT. PLOT | NUMBER | TYPE | BLOWS / FOOT | | SHEAR STRENGTH P.S.F. | | | | WP | W | WL | | |
| 601.6 | Groundlevel | | | | | | | | | | | | | | |
| 0.0 | | | | | | | | | | | | | | | |
| | Silty clay to clayey silt with traces of sand and gravel. | | 1 | SS | 65 | | | | | | | | | | |
| | | | 2 | SS | 32 | | | | | | | | | | |
| | | | 3 | SS | 27 | | | | | | | | | | |
| | | | 4 | SS | 63 | | | | | | | | | | |
| | Hard to Stiff. | | | | | | | | | | | | | | |
| | | | 5 | SS | 18 | | | | | | | | | | |
| 560.1 | | | 6 | SS | 13 | | | | | | | | | | |
| 41.5 | End of borehole. | | | | | | | | | | | | | | |

W.L. El.
592.0'Sal 10%
Si 77%
Cl 13%

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 8

FOUNDATION SECTION

JOB 66-F-22

LOCATION Gravel Rd. Sta. 14/37, 17' Lt. of E

ORIGINATED BY W.W.K.

W.P. 124-64

BORING DATE March 11, 1966.

COMPILED BY A.K.B.

DATUM Geodetic

BOREHOLE TYPE Dynamic Cone Penetration.

CHECKED BY K.G.S. *AK*

| SOIL PROFILE | | | SAMPLES | | | ELEV. SCALE | DYNAMIC PENETRATION RESISTANCE | | LIQUID LIMIT — WL | | BULK DENSITY | REMARKS |
|--------------|---------------------|-------------|---------|------|--------------|-------------|--------------------------------|-----------------------|--------------------|-------------------|--------------|---------|
| ELEV. DEPTH | DESCRIPTION | STRAT. PLOT | NUMBER | TYPE | BLOWS / FOOT | | BLOWS / FOOT | SHEAR STRENGTH P.S.F. | PLASTIC LIMIT — WP | WATER CONTENT — W | | |
| 601.7 | Groundlevel | | | | | | | | | | | |
| 0.0 | Penetration Only. | | | | | 600 | | | | | | |
| 8.4 | End of Penetration. | | | | | 590 | | | | | | |
| | | | | | | 580 | | | | | | |

WATER CONTENT %

EL. 593.3' Hammer Bouncing.

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 9

FOUNDATION SECTION

JOB 66-F-22

LOCATION Gravel Rd. Sta. 14+02, 17' Rt. of C

ORIGINATED BY W.W.K.

W.P. 124-64

BORING DATE March 11, 1966.

COMPILED BY A.K.B.

DATUM Geodetic

BOREHOLE TYPE Dynamic Cone Penetration.

CHECKED BY K.G.S. *AK*

| SOIL PROFILE | | | SAMPLES | | | DYNAMIC PENETRATION RESISTANCE | | LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W | | BULK DENSITY P.C.F. | REMARKS |
|--------------|---------------------|-------------|---------|------|--------------|--------------------------------|-----------------------|--|--|------------------------|---------|
| ELEV. DEPTH | DESCRIPTION | STRAT. PLOT | NUMBER | TYPE | BLOWS / FOOT | BLOWS / FOOT | SHEAR STRENGTH P.S.F. | WATER CONTENT % | | | |
| 600.4 | Groundlevel | | | | | | | | | | |
| 0.0 | Penetration Only. | | | | | | | | | | |
| 591.5 | | | | | | | | | | | |
| 8.9 | End of Penetration. | | | | | | | | | | |

ELEV. SCALE: 600, 590, 580
 DYNAMIC PENETRATION RESISTANCE: 20, 40, 60, 80, 100
 SHEAR STRENGTH P.S.F.: 20, 40, 60, 80, 100
 LIQUID LIMIT — WL
 PLASTIC LIMIT — WP
 WATER CONTENT — W
 WATER CONTENT %
 BULK DENSITY P.C.F.

@El. 591.5' Hammer Bouncing.

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 10

FOUNDATION SECTION

JOB 66-F-22

LOCATION Gravel Rd. Sta. 14+02, 17' Lt. of E

ORIGINATED BY W.W.K.

W.P. 124-64

BORING DATE March 9, 1966.

COMPILED BY A.K.B.

DATUM Geodetic

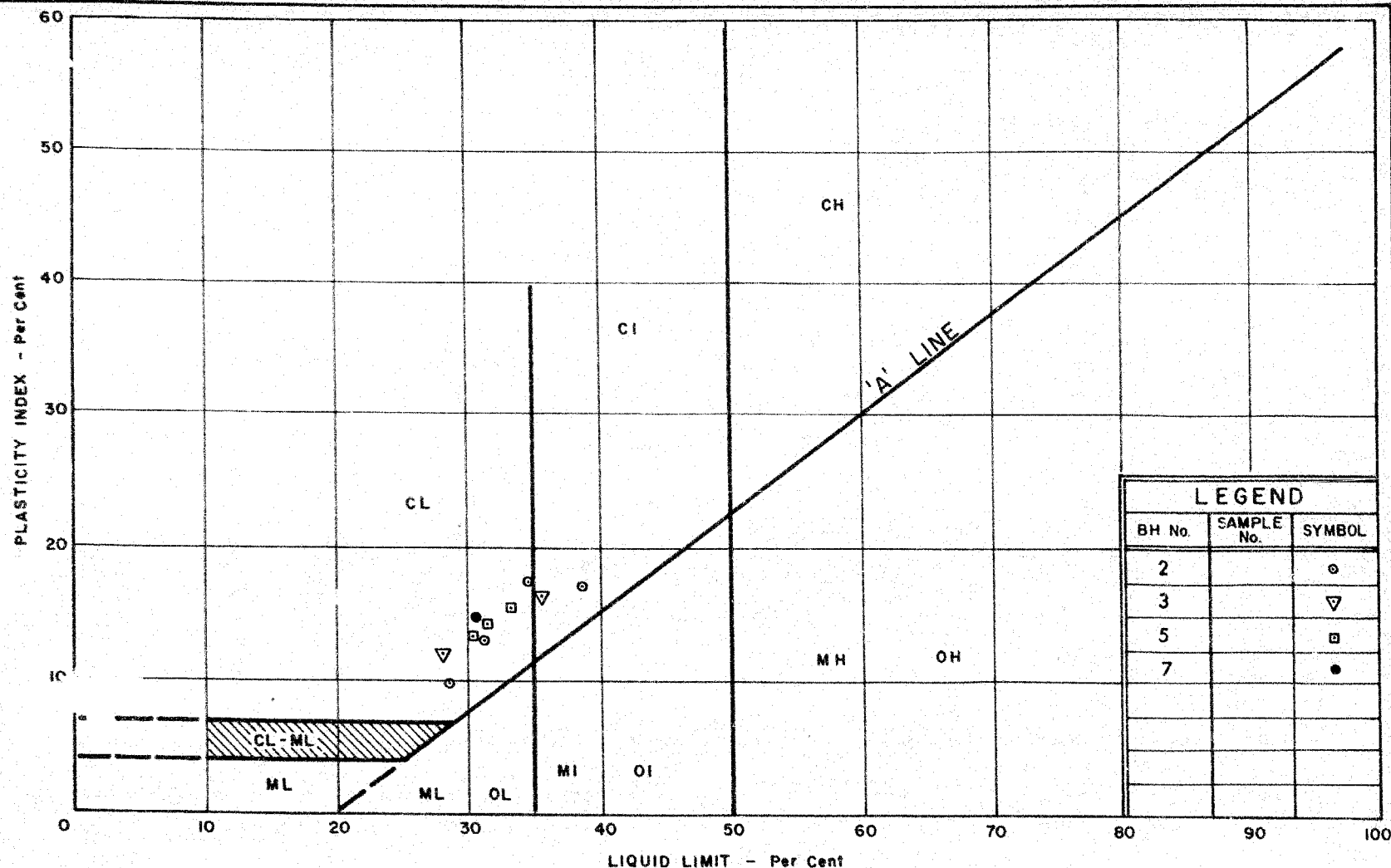
BOREHOLE TYPE Washboring, NX Casing.

CHECKED BY K.G.S.

| SOIL PROFILE | | SAMPLES | | | DYNAMIC PENETRATION RESISTANCE | | LIQUID LIMIT — WL PLASTIC LIMIT — WP | | BULK DENSITY P.C.F. | REMARKS |
|--------------|-----------------------------|-------------|--------|------|--------------------------------|-------------|---|-------------------|------------------------|---------|
| ELEV. DEPTH | DESCRIPTION | STRAT. PLOT | NUMBER | TYPE | BLOWS / FOOT | ELEV. SCALE | BLOWS / FOOT | WATER CONTENT — W | | |
| 601.0 | Groundlevel | | | | | 600 | | | | |
| 0.0 | | | | | | | | | | |
| | | | 1 | SS | 58 | | | | | |
| | | | 2 | SS | 37 | 590 | | | | |
| | | | 3 | SS | 24 | | | | | |
| | | | 4 | SS | 19 | 580 | | | | |
| | | | 5 | SS | 24 | | | | | |
| | | | | | | 570 | | | | |
| | | | 6 | SS | 14 | | | | | |
| | | | | | | 560 | | | | |
| | | | 7 | SS | 10 | | | | | |
| | | | | | | 550 | | | | |
| | | | 8 | SS | 20 | | | | | |
| | | | | | | 540 | | | | |
| | | | 9 | SS | 8 | 530 | | | | |
| | | | | | | 520 | | | | |
| | | | 10 | SS | 10 | | | | | |
| | | | | | | 510 | | | | |
| 504.8 | End of borehole. | | | | | | | | | |
| 96.2 | Glacial Till Very dense. | | | | | | | | | |

@El. 590.3' Hammer Bouncing.

W.L. El.
591.1'



| LEGEND | | |
|--------|------------|--------|
| BH No. | SAMPLE No. | SYMBOL |
| 2 | | ○ |
| 3 | | ▽ |
| 5 | | □ |
| 7 | | ● |
| | | |
| | | |
| | | |
| | | |



DEPARTMENT OF HIGHWAYS
MATERIALS and
TESTING
DIVISION

PLASTICITY CHART

W.P. No. 124 - 64

JOB No. 66-F-22

ABBREVIATIONS USED IN THIS REPORT

PENETRATION RESISTANCE

STANDARD PENETRATION RESISTANCE 'N' - THE NUMBER OF BLOWS REQUIRED TO ADVANCE A STANDARD SPLIT SPOON SAMPLER 12 INCHES INTO THE SUBSOIL, DRIVEN BY MEANS OF A 140 POUND HAMMER FALLING FREELY A DISTANCE OF 30 INCHES.

DYNAMIC PENETRATION RESISTANCE - THE NUMBER OF BLOWS REQUIRED TO ADVANCE A 2 INCH, 60 DEGREE CONE, FITTED TO THE END OF DRILL RODS, 12 INCHES INTO THE SUBSOIL, THE DRIVING ENERGY BEING 350 FOOT POUNDS PER BLOW.

DESCRIPTION OF SOIL

THE CONSISTENCY OF COHESIVE SOILS AND THE RELATIVE DENSITY OR DENSENESS OF COHESIONLESS SOILS ARE DESCRIBED IN THE FOLLOWING TERMS:-

| <u>CONSISTENCY</u> | <u>'N' BLOWS / FT.</u> | <u>c LB / SQ FT.</u> | <u>DENSENESS</u> | <u>'N' BLOWS / FT.</u> |
|--------------------|------------------------|----------------------|------------------|------------------------|
| VERY SOFT | 0 - 2 | 0 - 250 | VERY LOOSE | 0 - 4 |
| SOFT | 2 - 4 | 250 - 500 | LOOSE | 4 - 10 |
| FIRM | 4 - 8 | 500 - 1000 | COMPACT | 10 - 30 |
| STIFF | 8 - 15 | 1000 - 2000 | DENSE | 30 - 50 |
| VERY STIFF | 15 - 30 | 2000 - 4000 | VERY DENSE | > 50 |
| HARD | > 30 | > 4000 | | |

TYPE OF SAMPLE

| | | | |
|------|-----------------------|-------------------------------|-------------------|
| S.S. | SPLIT SPOON | T.W. | THINWALL OPEN |
| W.S. | WASHED SAMPLE | T.P. | THINWALL PISTON |
| S.B. | SCRAPER BUCKET SAMPLE | O.S. | OESTERBERG SAMPLE |
| A.S. | AUGER SAMPLE | F.S. | FOIL SAMPLE |
| C.S. | CHUNK SAMPLE | R.C. | ROCK CORE |
| S.T. | SLOT TUBE SAMPLE | | |
| | P.H. | SAMPLE ADVANCED HYDRAULICALLY | |
| | P.M. | SAMPLE ADVANCED MANUALLY | |

SOIL TESTS

| | | | |
|-----|---------------------------------|------|-----------------|
| Qu | UNCONFINED COMPRESSION | L.V. | LABORATORY VANE |
| Q | UNDRAINED TRIAXIAL | F.V. | FIELD VANE |
| Qcu | CONSOLIDATED UNDRAINED TRIAXIAL | C | CONSOLIDATION |
| Qd | DRAINED TRIAXIAL | S | SENSITIVITY |

ABBREVIATIONS USED IN THIS REPORT

SOIL PROPERTIES

| | |
|------------|--|
| γ | UNIT WEIGHT OF SOIL (BULK DENSITY) |
| γ_s | UNIT WEIGHT OF SOLID PARTICLES |
| γ_w | UNIT WEIGHT OF WATER |
| γ_d | UNIT DRY WEIGHT OF SOIL (DRY DENSITY) |
| γ' | UNIT WEIGHT OF SUBMERGED SOIL |
| G | SPECIFIC GRAVITY OF SOLID PARTICLES $G = \frac{\gamma_s}{\gamma_w}$ |
| e | VOID RATIO |
| n | POROSITY |
| w | WATER CONTENT |
| S_r | DEGREE OF SATURATION |
| w_L | LIQUID LIMIT |
| w_p | PLASTIC LIMIT |
| I_p | PLASTICITY INDEX |
| s | SHRINKAGE LIMIT |
| I_L | LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$ |
| I_C | CONSISTENCY INDEX = $\frac{w_h - w}{I_p}$ |
| e_{max} | VOID RATIO IN LOOSEST STATE |
| e_{min} | VOID RATIO IN DENSEST STATE |
| I_D | DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$ |
| | RELATIVE DENSITY D_r IS ALSO USED |
| h | HYDRAULIC HEAD OR POTENTIAL |
| q | RATE OF DISCHARGE |
| v | VELOCITY OF FLOW |
| i | HYDRAULIC GRADIENT |
| k | COEFFICIENT OF PERMEABILITY |
| j | SEEPAGE FORCE PER UNIT VOLUME |
| m_v | COEFFICIENT OF VOLUME CHANGE = $\frac{-\Delta e}{(1+e)\Delta\sigma}$ |
| C_v | COEFFICIENT OF CONSOLIDATION |
| C_c | COMPRESSION INDEX = $\frac{\Delta e}{\Delta \log_{10} \sigma}$ |
| T_v | TIME FACTOR = $\frac{C_v t}{d^2}$ (d, DRAINAGE PATH) |
| U | DEGREE OF CONSOLIDATION |
| τ_t | SHEAR STRENGTH |
| c' | EFFECTIVE COHESION INTERCEPT |
| ϕ' | EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION |
| c_u | APPARENT COHESION |
| ϕ_u | APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION |
| μ | COEFFICIENT OF FRICTION |
| S_t | SENSITIVITY |

GENERAL

| | |
|---------------------------|-----------------------------------|
| π | = 3.1416 |
| e | BASE OF NATURAL LOGARITHMS 2.7183 |
| $\log_e a$ OR $\ln a$ | NATURAL LOGARITHM OF a |
| $\log_{10} a$ OR $\log a$ | LOGARITHM OF a TO BASE 10 |
| t | TIME |
| g | ACCELERATION DUE TO GRAVITY |
| V | VOLUME |
| W | WEIGHT |
| M | MOMENT |
| F | FACTOR OF SAFETY |

STRESS AND STRAIN

| | |
|------------|--|
| u | PORE PRESSURE |
| σ | NORMAL STRESS |
| σ' | NORMAL EFFECTIVE STRESS ($\bar{\sigma}$ IS ALSO USED) |
| τ | SHEAR STRESS |
| ϵ | LINEAR STRAIN |
| γ | SHEAR STRAIN |
| ν | POISSON'S RATIO (μ IS ALSO USED) |
| E | MODULUS OF LINEAR DEFORMATION (YOUNG'S MODULUS) |
| G | MODULUS OF SHEAR DEFORMATION |
| K | MODULUS OF COMPRESSIBILITY |
| η | COEFFICIENT OF VISCOSITY |

EARTH PRESSURE

| | |
|----------|---|
| d | DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE |
| δ | ANGLE OF WALL FRICTION |
| K | DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS |
| K_0 | COEFFICIENT OF EARTH PRESSURE AT REST |

FOUNDATIONS

| | |
|-------|--|
| B | BREADTH OF FOUNDATION |
| L | LENGTH OF FOUNDATION |
| D | DEPTH OF FOUNDATION BENEATH GROUND |
| N | DIMENSIONLESS COEFFICIENT USED WITH A SUFFIX APPLYING TO SPECIFIC GRAVITY, DEPTH AND COHESION ETC. IN THE FORMULA FOR BEARING CAPACITY |
| k_s | MODULUS OF SUBGRADE REACTION |

SLOPES

| | |
|---------|--|
| H | VERTICAL HEIGHT OF SLOPE |
| D | DEPTH BELOW TOE OF SLOPE TO HARD STRATUM |
| β | ANGLE OF SLOPE TO HORIZONTAL |

MEMORANDUM

RECD DEC 1, 1965

To: Mr. A. Sternae,
Principal Foundation Engineer,
Room 107, Lab. Bldg.

From: Bridge Division,
Downsview, Ontario.

Date: November 29, 1965.

Our File Ref.

IN REPLY TO

SUBJECT: W.P. 124-64,
Site 6-235,
Rochester Twp. Road,
Concession 2 Underpass,
Hwy. 401 - District 1.

66-27

We are sending herewith two (2) prints of Bridge Site Plan E-4364-1 on which we have marked in red the proposed location of the above structure.

The bridge site is readily accessible. It is 7.1 miles west of Hwy. 77.

Please make the necessary arrangement for foundations soils investigation. We will be pleased to have your report in due course.

NZ/im
cc. S. McCombie
G. Scott
M. D. Smith

C. Zoltay
M. Zoltay,
for G. Scott,
Regional Bridge Location Engineer.

COMPLETION DATE APRIL 10 1966

Mr. A. W. Watt,
Regional Bridge Location Engr.,
Regional Office (London).

Foundation Section,
Materials & Testing Div.,
Room 107, Lab. Bldg.

July 22, 1966

W.P. 124-64, Bridge Site No. 6-235,
Rochester Twp. Rd., Con. 2, Underpass,
7.1 Miles West of Hwy. 77, Hwy. 401,
District 1, Chatham.

The Preliminary Plan for the above mentioned
structure has been reviewed.

The designer appears to have complied with the
recommendations contained in the foundation report.

KGS/WieF

K. C. Selby
K. C. Selby,
SUPERVISING FOUNDATION ENGR
For:
A. G. Stermac,
PRINCIPAL FOUNDATION ENGR.

cc: Foundations Office ✓
Gen. Files

MEMORANDUM

To: Mr. A. G. Stermac
Principal Foundation Engineer
Lab Building
D O W N S V I E W

FROM: A. P. Watt

DATE: July 5, 1966

OUR FILE REF.

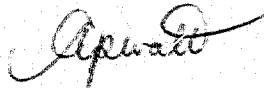
IN REPLY TO:

SUBJECT: WP 124-64, Bridge Site 6-235,
Rochester Twp. Ed. Con. 2 Underpass,
7.1 miles west of Hwy. 77,
Hwy. 401,
District 1, Chatham.

W.J. 66-F-22

Attached please find one copy of the preliminary
plan D-5952-P1 for the above structure.

Would you kindly review the bridge foundations
proposed and inform me if they are satisfactory.



A. P. WATT
REGIONAL BRIDGE LOCATION ENGINEER

APW:gf
Encl.

c.c. Mr. S. McCombie

#66-F-22

W.P. #124-64

Hwy. #401

ROCHESTER

Twp. Rd.

